Ethanol and Biodiesel in North Carolina: A Natural Fit

Larry Shirley
State Energy Office
NC Department of Administration
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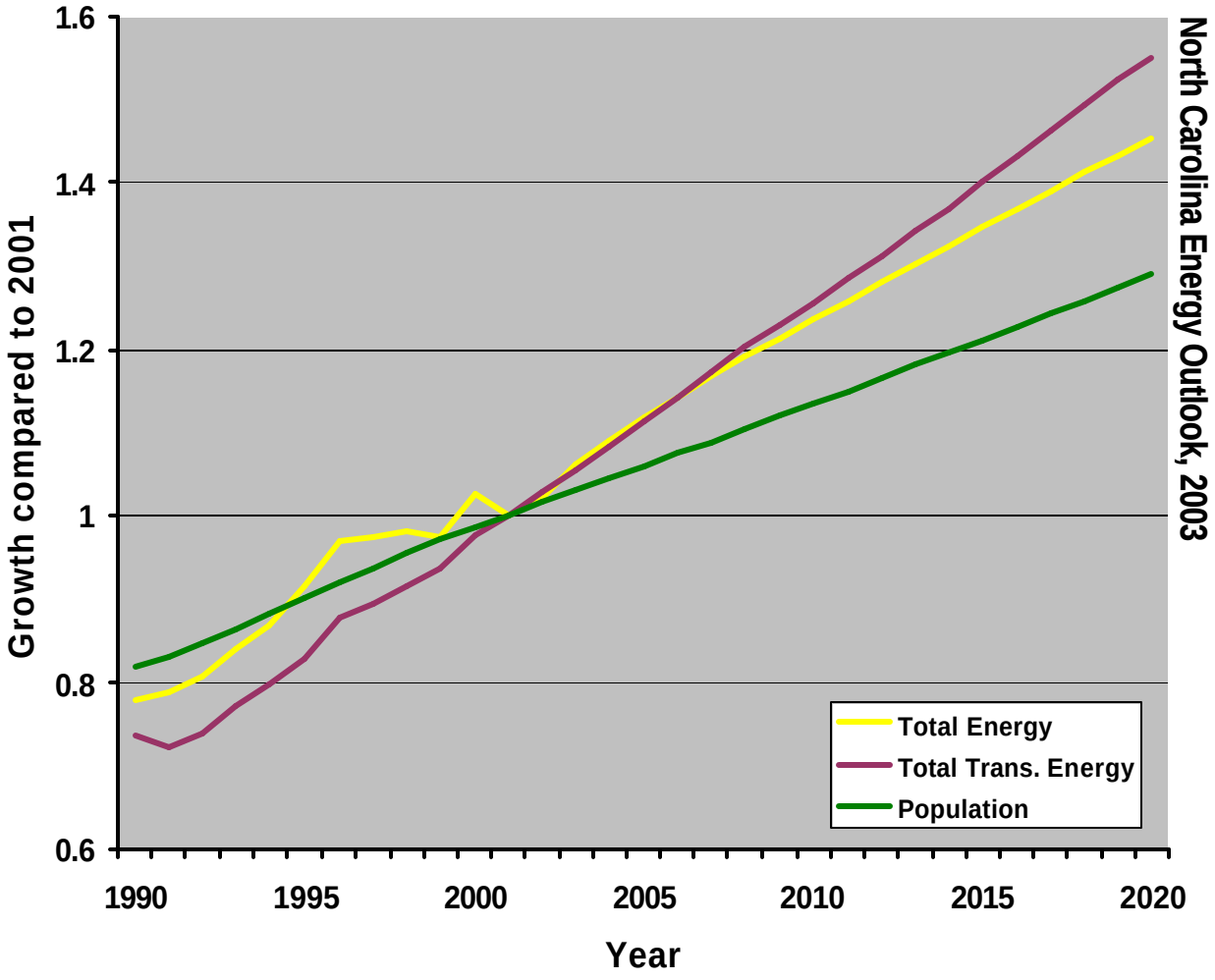
Contributors / Acknowledgement

- Rocky Mountain Institute
- Florida Solar Energy Center
- NC Solar Center at NC State University
- U.S. DOE
- NC A&T's Center for Energy Research and Technology
- ASU Energy Center

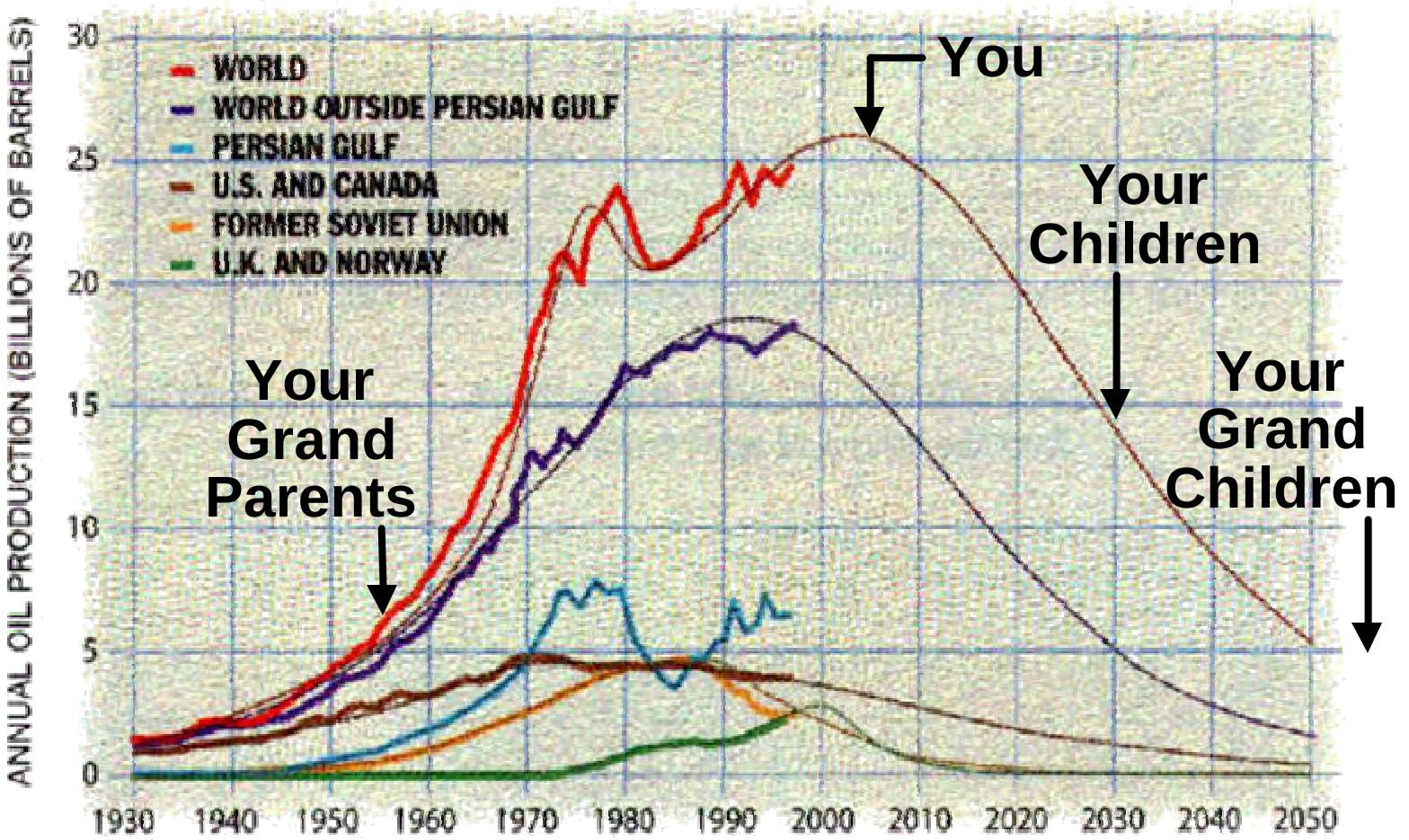
State Energy Office

- Advancing ***energy efficiency*** in industrial, utility, transportation, government, and residential sectors.
- Developing the state's abundant ***renewable energy resources.***
- Accelerating use of ***alternative fuels and vehicles.***
- Responding to ***energy emergencies.***

Energy Trends

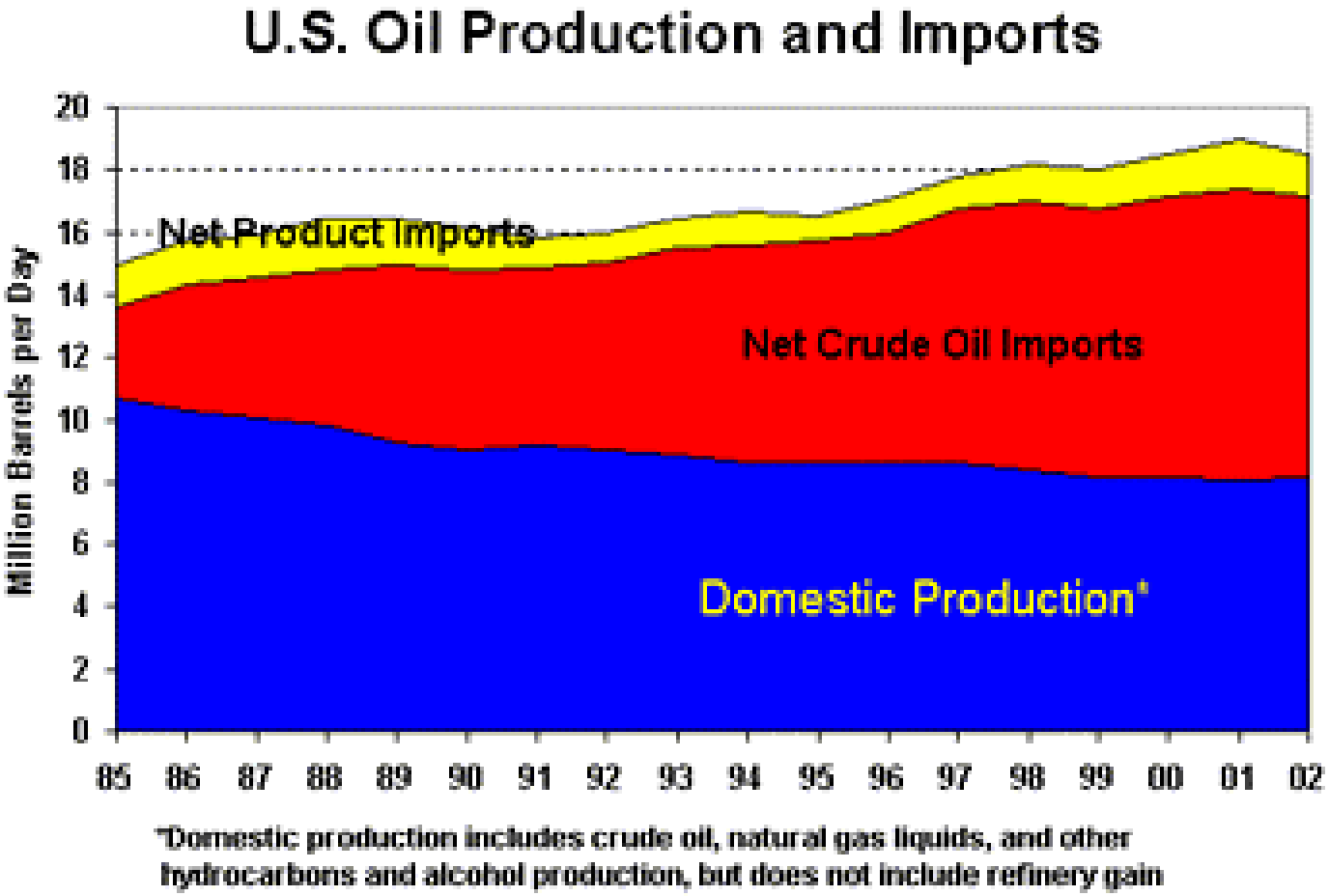


World Oil – In Perspective

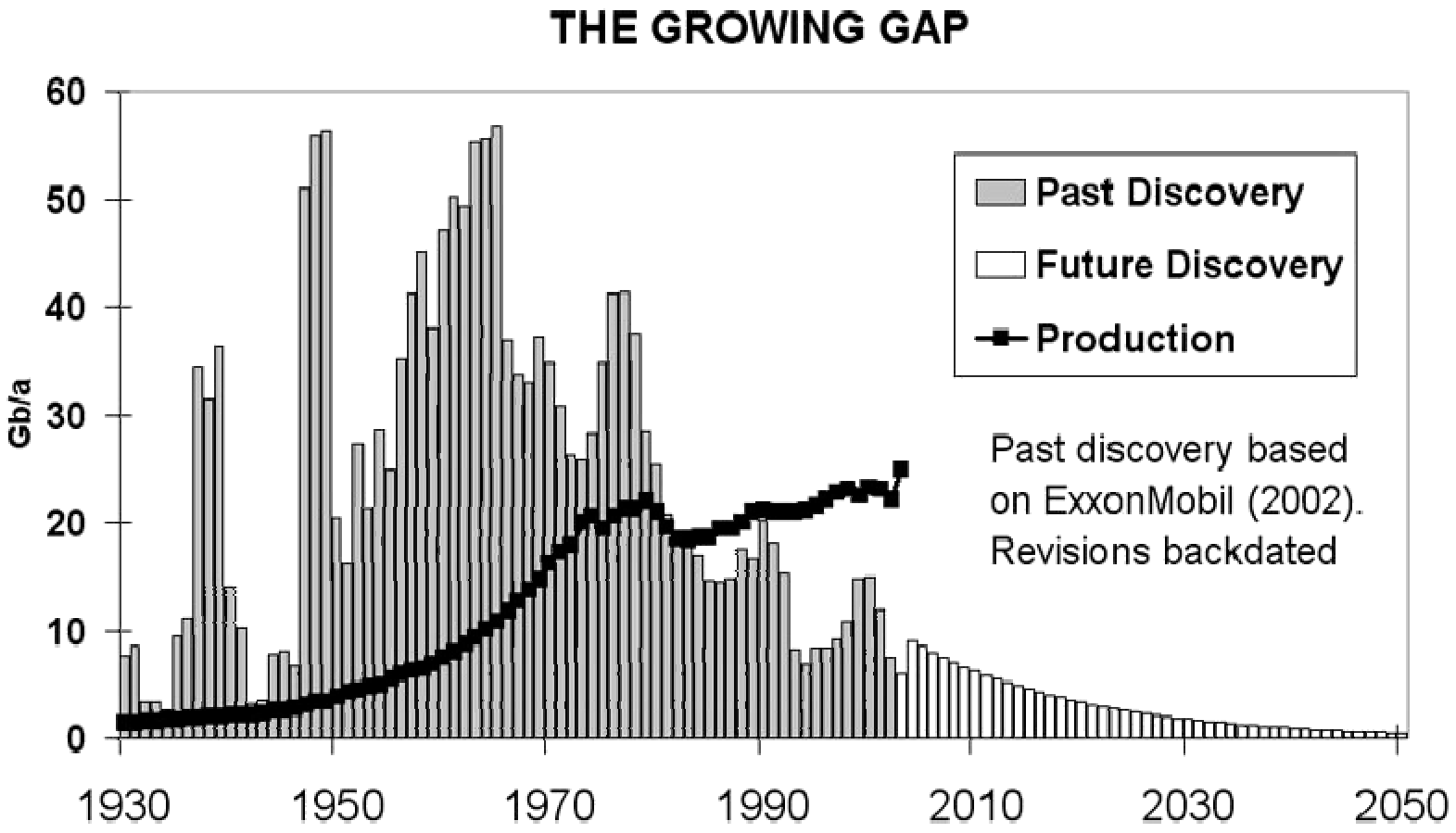


Source: Campbell, Colin J. and Jean H. Laherrere, "The End of Cheap Oil." *Scientific American*, March 1998.

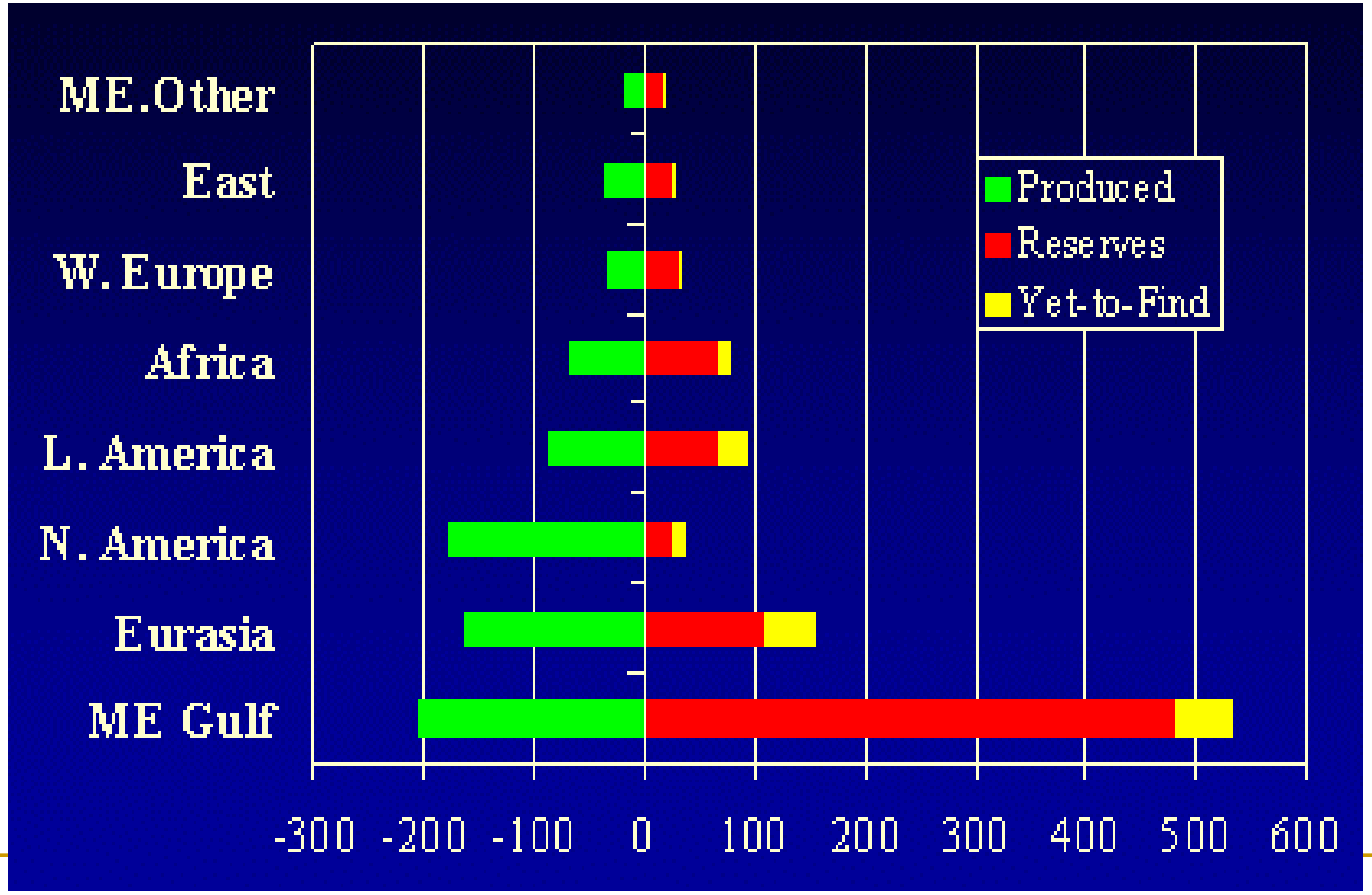
US Petroleum Production vs. Imports



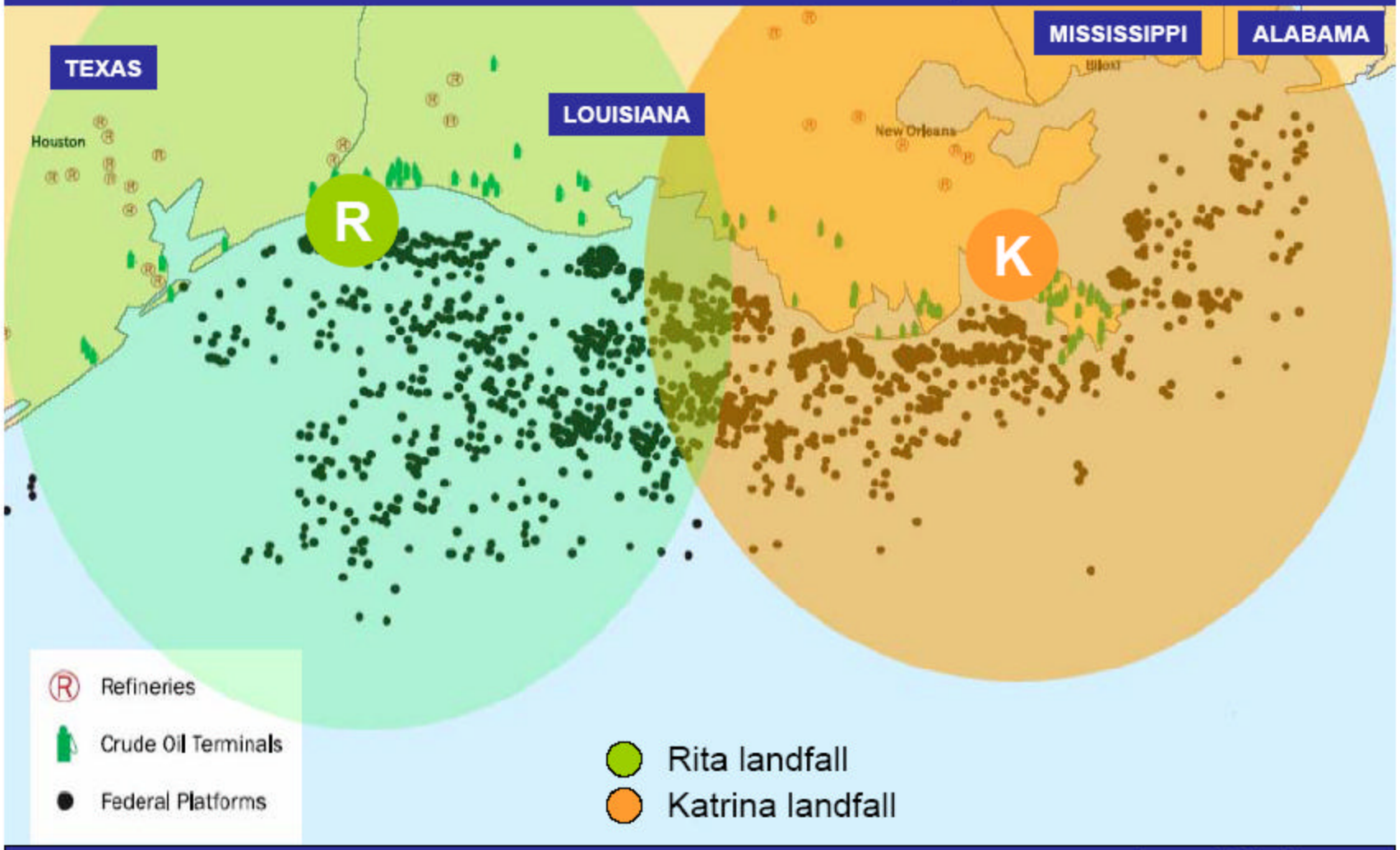
New Oil?


THE GROWING GAP
Gb/a
60
50
40
30
20
10
0
1930
1950
1970
1990
2010
2030
2050
Past Discovery
Future Discovery
Production
Past discovery based on ExxonMobil (2002). Revisions backdated

Where The Oil Is



Hurricanes Rita, Katrina And Gulf Oil & Natural Gas Operations

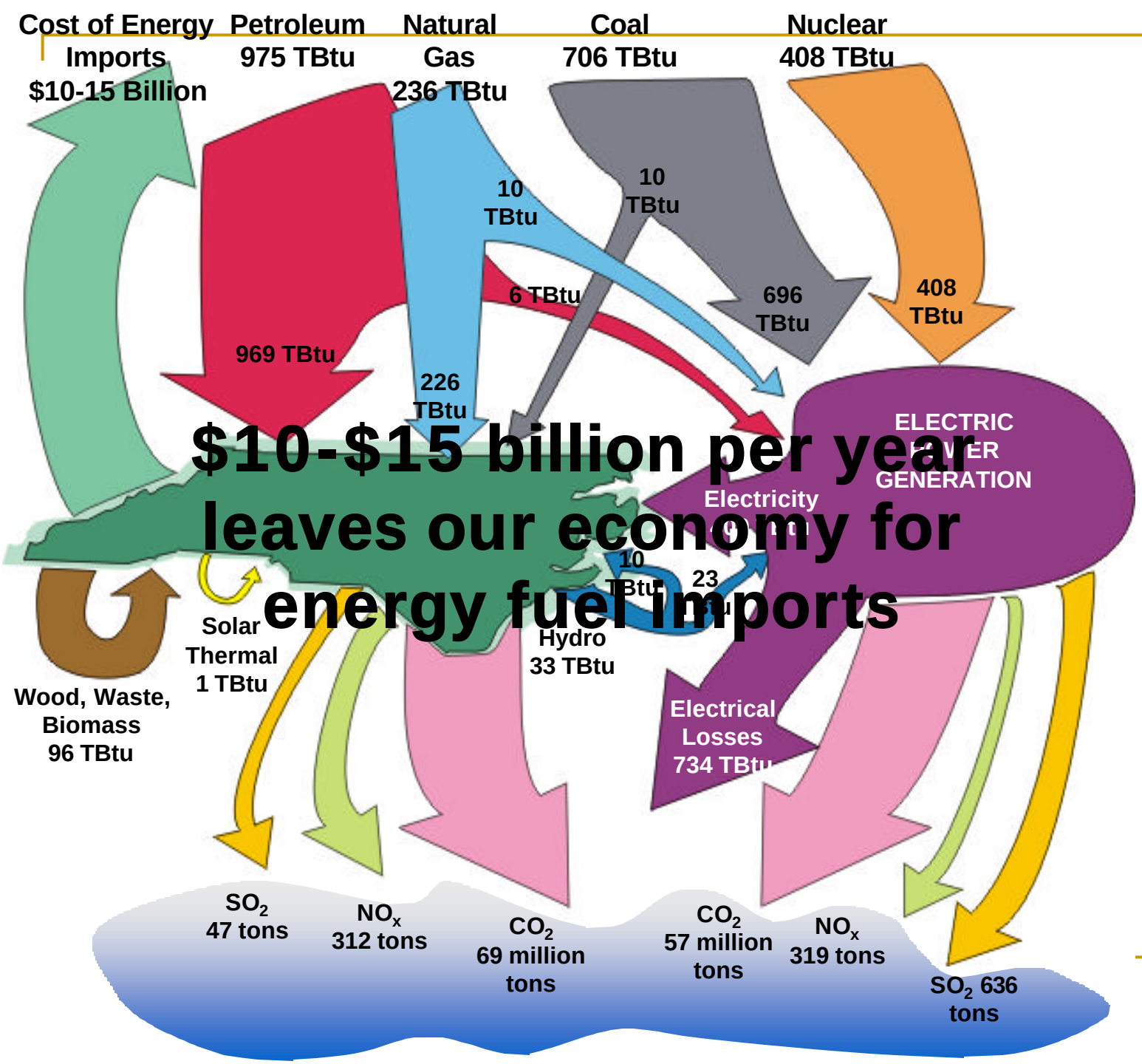


Sources: NOAA, EIA

Katrina and Rita

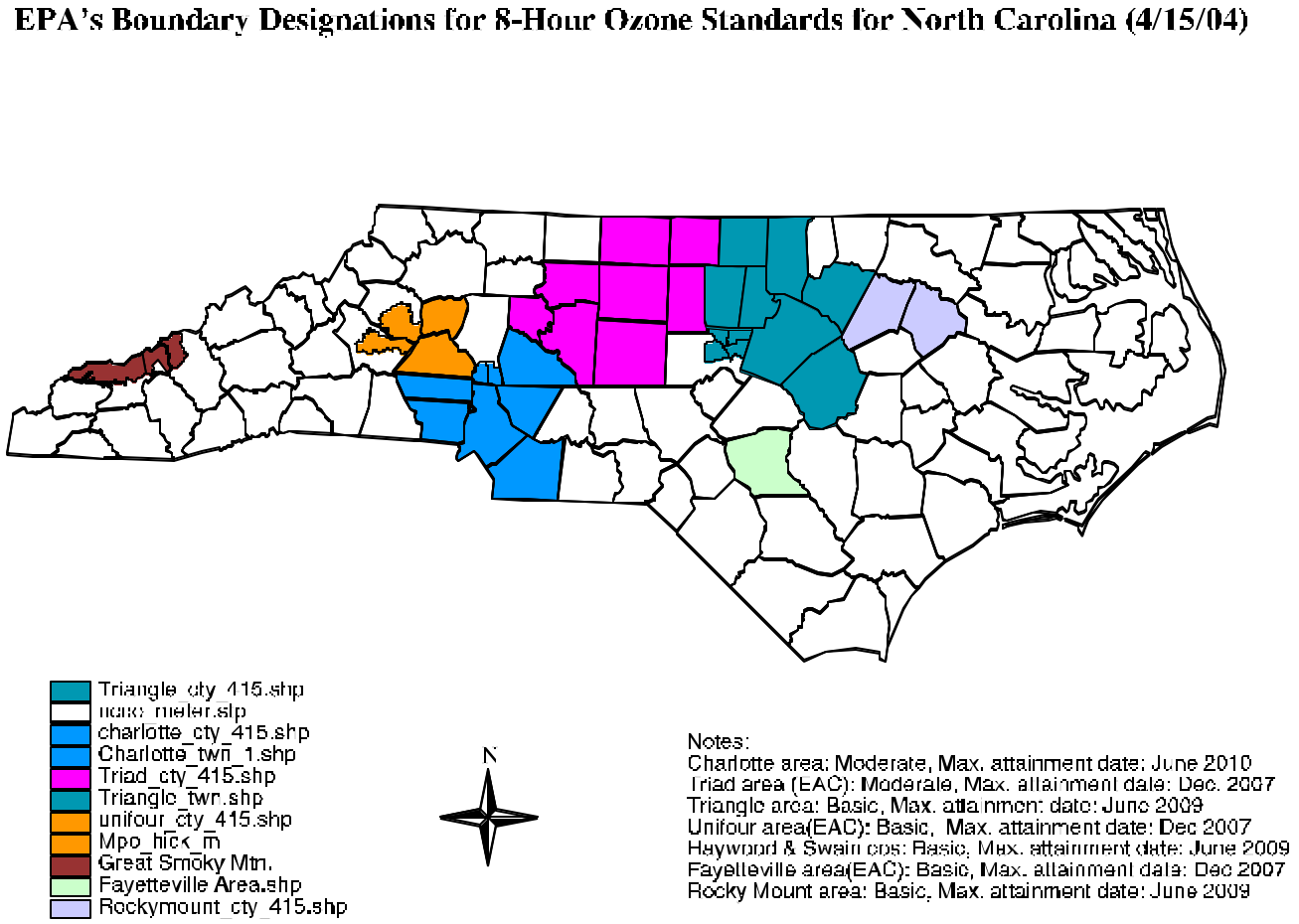
- 29% of Refinery Capacity Brought Down
- 66% of Gulf oil production shut-in
- 54% of Gulf natural gas production out
- 16 Natural Gas processing plants down
- Impacts will spill over to economy
- NC vulnerable: reliant on two pipelines with little storage

Energy Flows In North Carolina

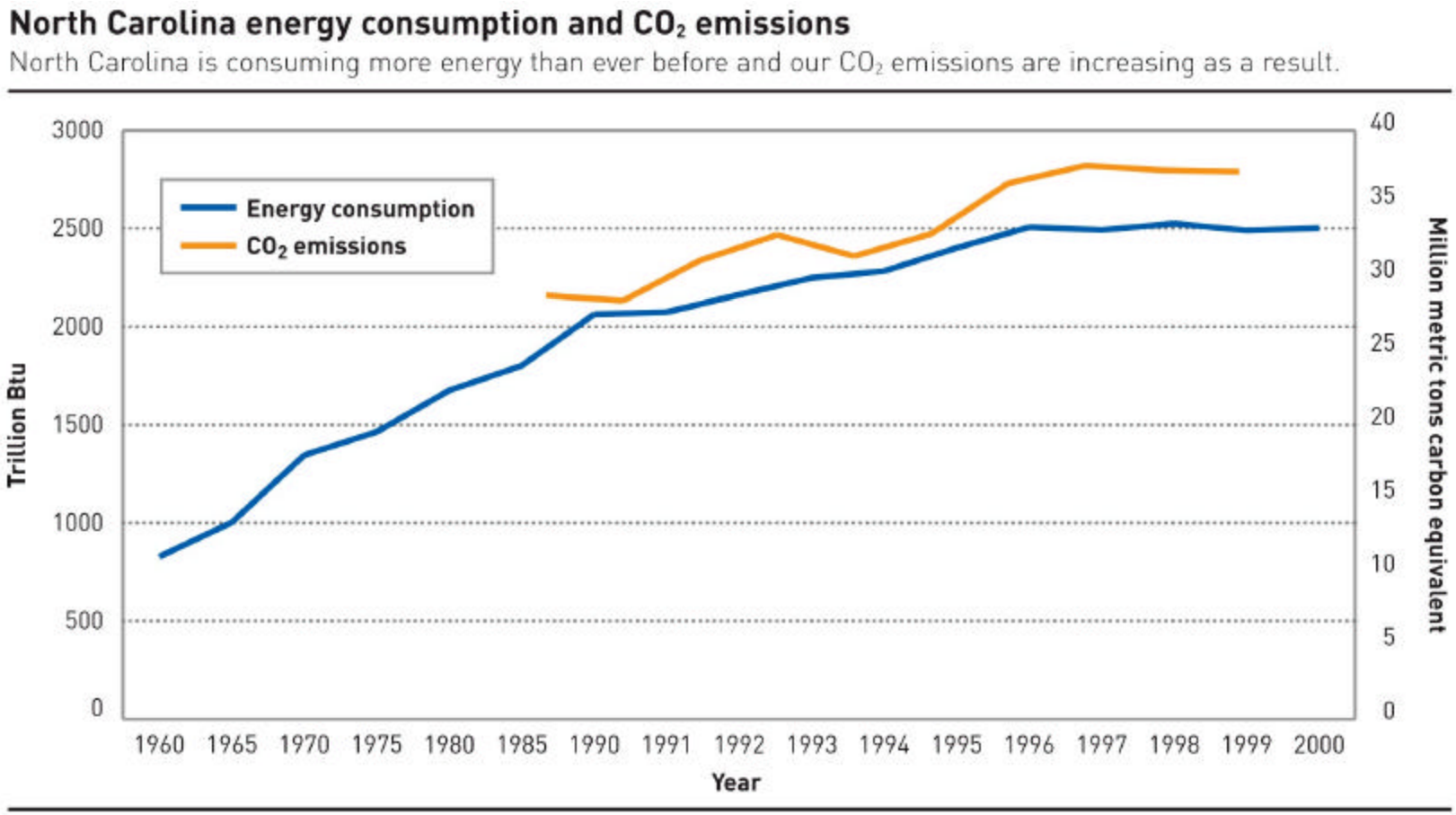


$10-$15 billion per year leaves our economy for energy fuel imports

Ozone Nonattainment Areas



Global Warming

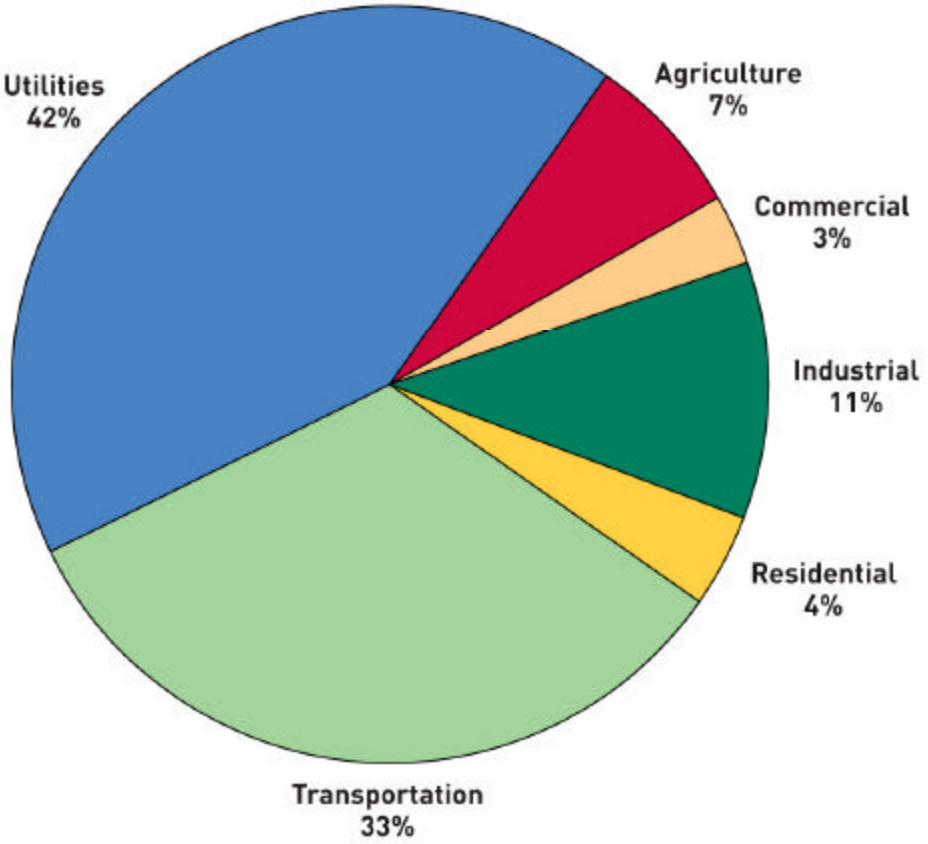


USEPA, USDOE

FIGURE 7

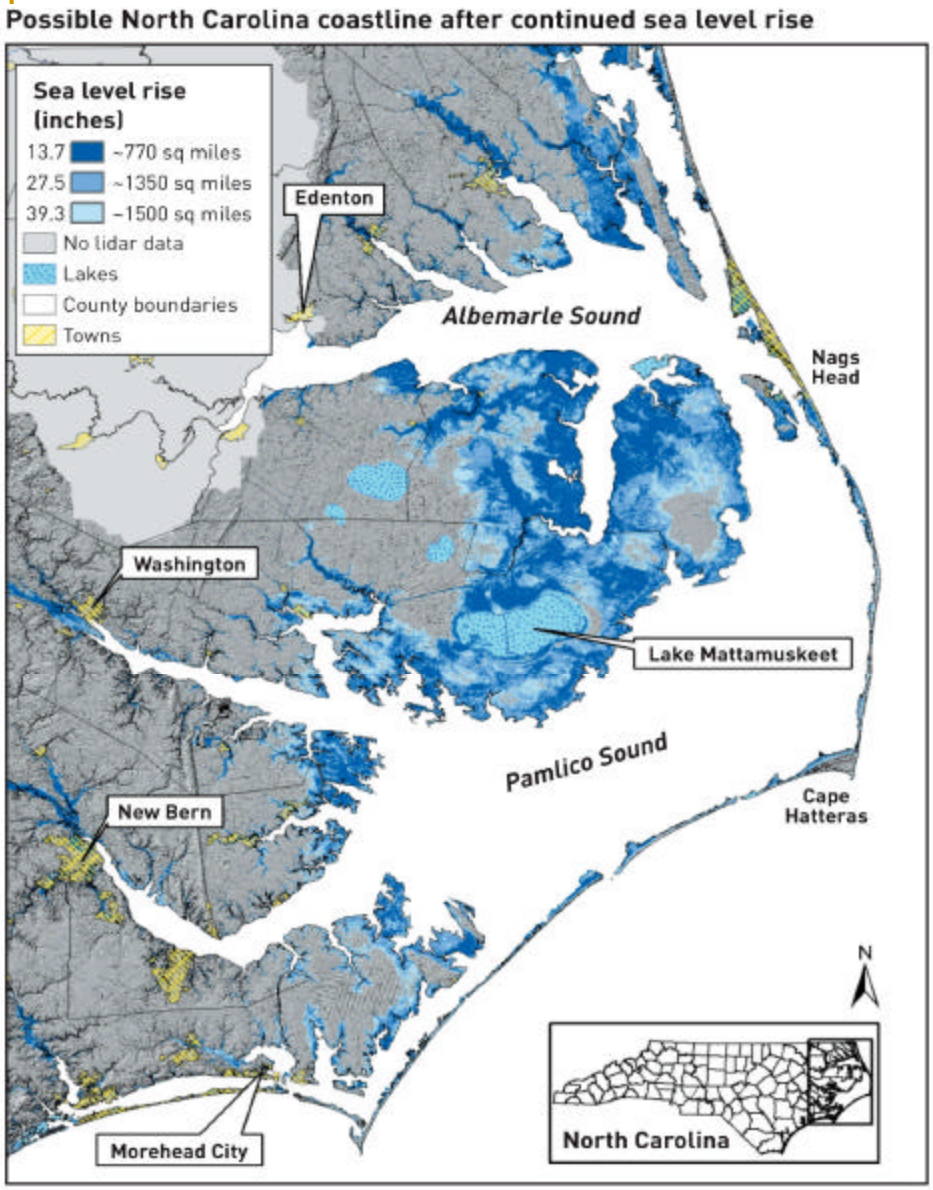
Primary sources of greenhouse gases in North Carolina, 1999 (million metric tons carbon equivalent)

Most greenhouse gases come from our tailpipes and our electricity use.



Source: United States Environmental Protection Agency

Sea Level Rise – Climate Change

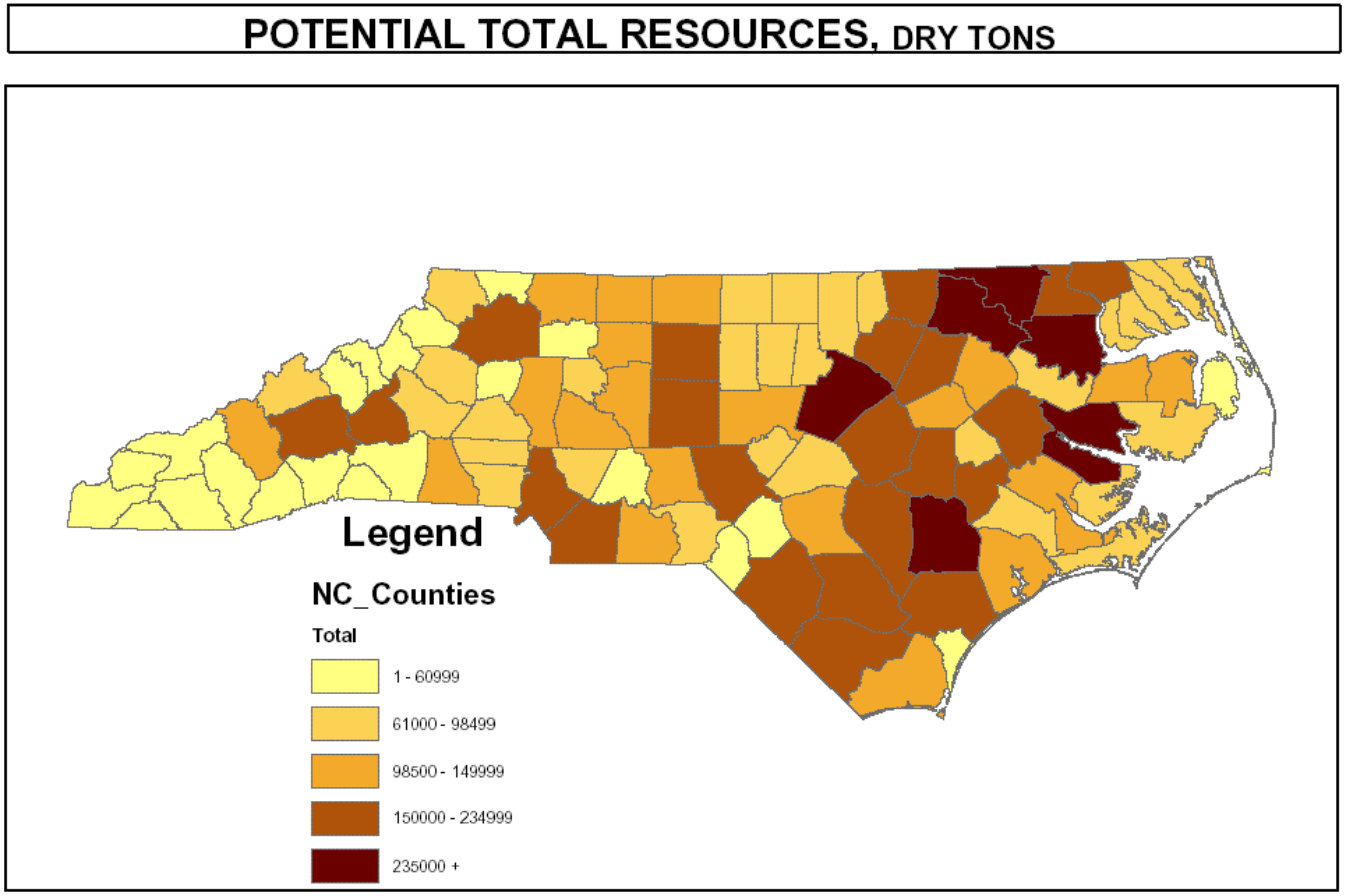


Ben Poulter, Duke University; Sam Pearsall, The Nature Conservancy

North Carolina: The Saudi Arabia of Biomass

- Electricity Production (1,779 MW)
- Ethanol
- Biodiesel
- Landfill Methane Gas
- Animal Waste to biogas (methane)
- Cofiring/Boiler Fuel
- Wood, Agricultural and Urban Waste
- Energy Crops

Where is NC's biomass?

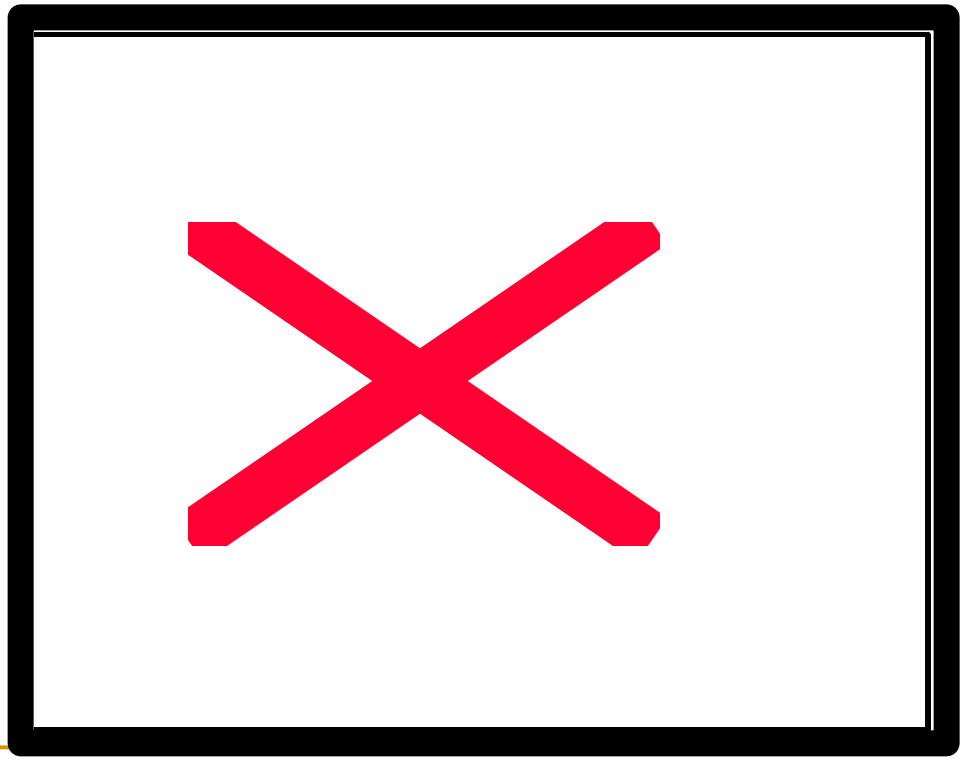


Alternative Fuels

- Ethanol: 5,500 state vehicles/E-85
- E-10 useable by anyone/MTBE Ban
- Biodiesel: Soybean/Canola or Waste Oil
- 20% blend can be used by everyone
- State must cut petroleum use by 20% by 2010
- Clean Cities Programs

Benefits of Biofuels

- Ease of Use
- Economy-Direct aid to U.S. farmers
- Significantly better Emissions
- Better for the Environment



Ethanol and Greenhouse Gases

- Corn E-85 = 18-29% reduction
- Cellulose E-85 = 86% reduction
- Biodiesel = 78% reduction

The BioFuels Opportunity

- **Biofuels are the only North American energy sources capable of providing 2+ Million Barrels per day**
- **New biofuels technologies have the potential to supply fuels below the crude equivalent of $30/bbl**
- **Cellulosic biofuels could increase farmer income to $430–640/acre-year, doubling or tripling farmer income per acre**
  - Uses mostly Conservation Reserve land, not prime farmland
  - Potential for near zero net carbon emissions
  - Lower water and fertilizer requirements than most food or oil crops
- **Existing US engines can handle 85% blends of ethanol with minimal modifications, and 20% blending of biodiesel.**

Biofuel Drivers

- **National and State Security**:
  - Lower dependence on imported oil from unstable/hostile regimes
  - Can be produced in NC by NC farmers

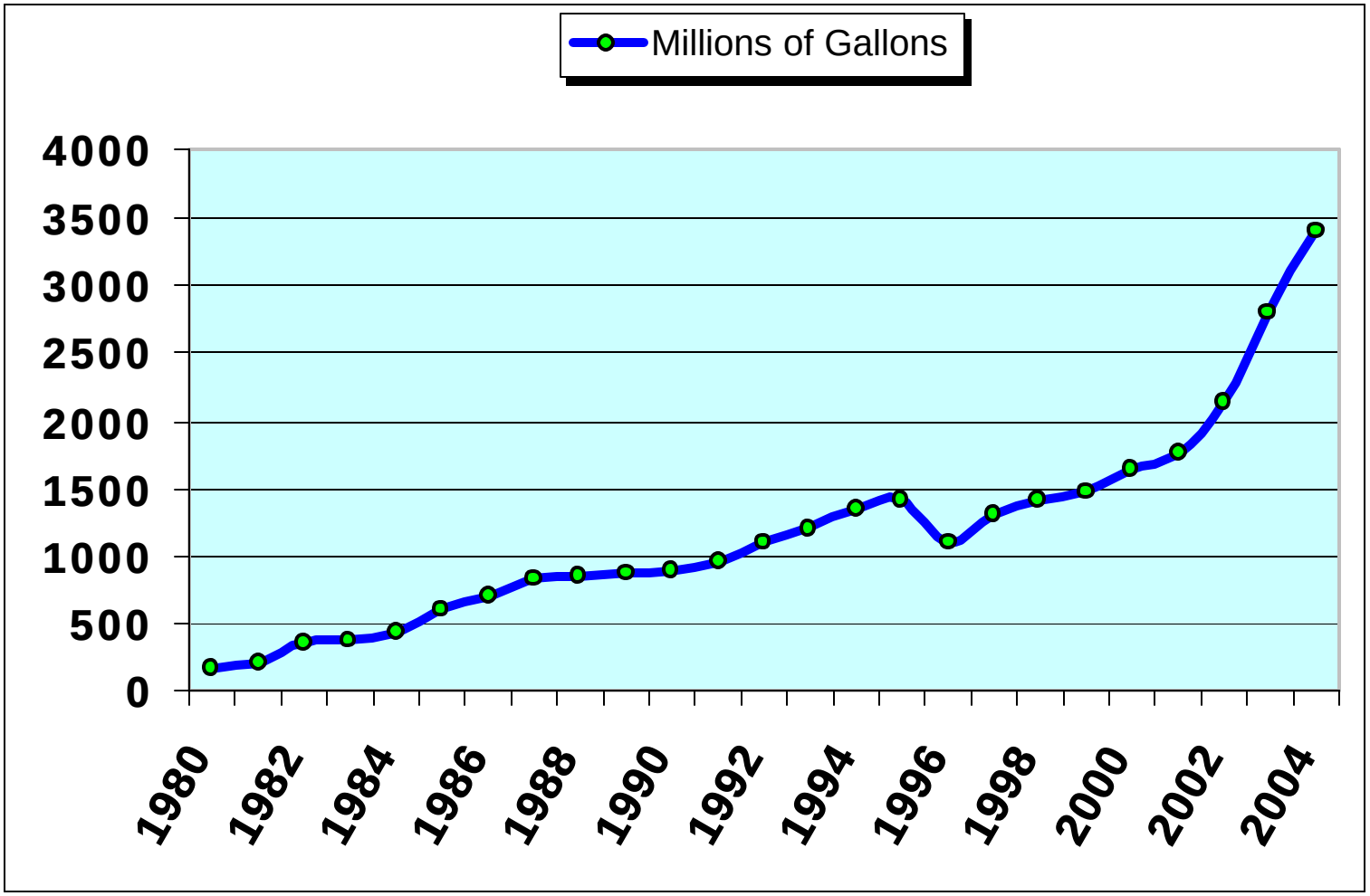
- **Economic Business Opportunities:**
  - Provides buffer to high and volatile oil prices
  - Keeps energy dollars circulating in NC
  - Tax incentives and subsidies available in NC
  - Create vibrant rural economies from ~$40 billion annual biofuel purchases
  - 750,000 new rural jobs from biofuels industry

- **Environmental Benefits**
  - Clean Air Act requirements
  - Greenhouse Gas Emission Reductions
  - Lower water, fertilizer requirements than most food or oil crops

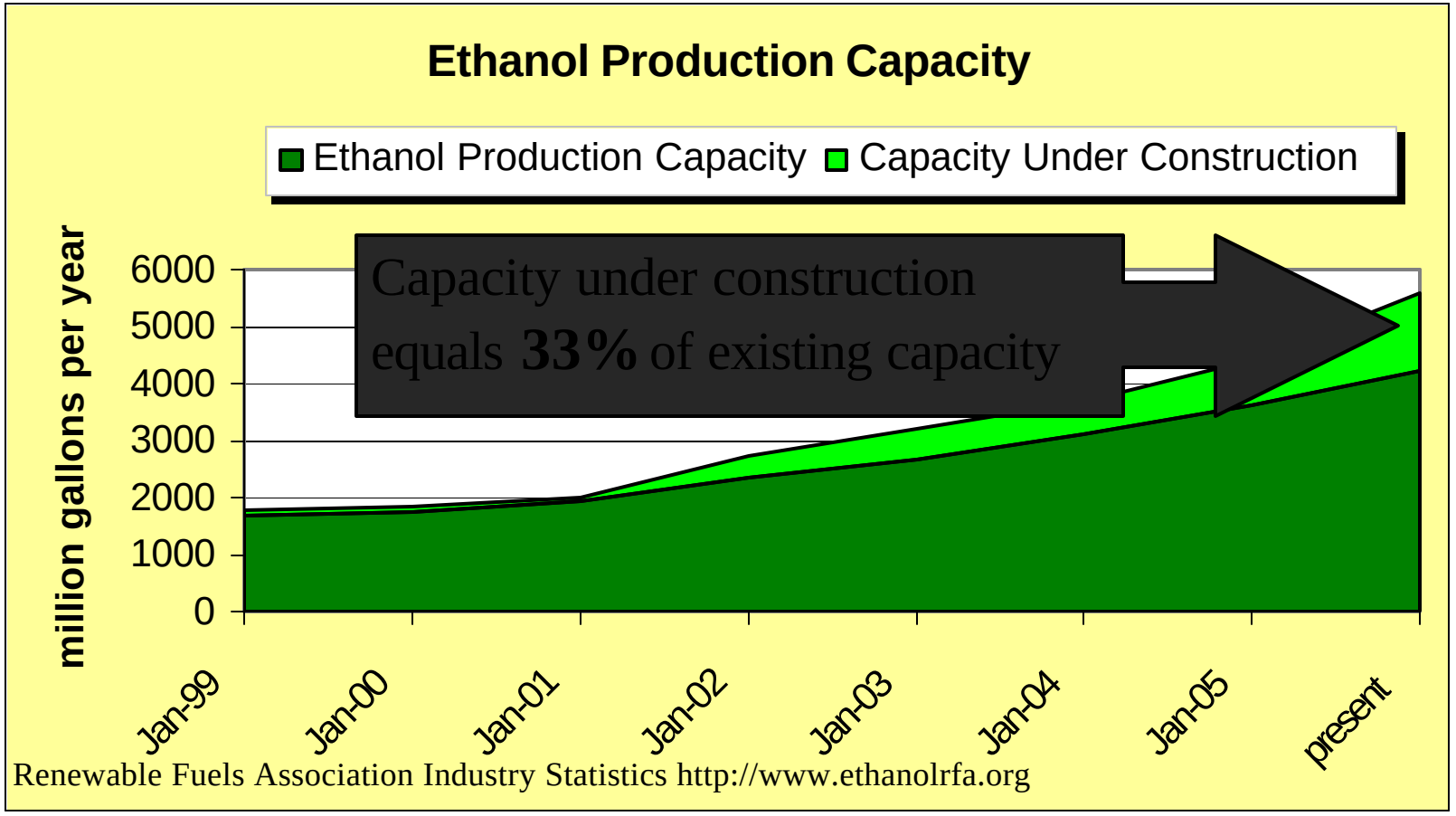
ETHANOL

- Renewable fuel produced by fermenting organic materials
- High octane, non-toxic, water soluble, biodegradable
- Lower life cycle greenhouse gas emissions
- Supports agriculture

US Ethanol Production 1980-2004



Ethanol Potential



Renewable Fuels Association Industry Statistics http://www.ethanolrfa.org

NC Ethanol Plant Employment Impact

40 million gallon plant = 33 direct jobs
- Average Salary $36,000/ yr

10 plants = 330 jobs…….10,000 indirect jobs

400 million gallons = 10% of annual gasoline usage

Potential exists on 476,000 idle acres in North Carolina

3 Plants Planned = 350 million gallons

NC Bioethanol
Switchgrass (SG) example:

- $270-540/acre/year product revenue
- $26-128/acre/year carbon credit
- Ethanol yield/ton of SG= 100-180 gallons
- Average 1120 gal/acre (8tns/acre@140gal/tn)
- 40 mm gal refinery= 40,000 +- acres
- Corn would require 4X the acreage

For North Carolina, this could be a $1 billion+ a year opportunity

- North Carolina could produce 30-36 million barrels per year of ethanol from forestry wastes, mill residues, agricultural residues, CRP/other acreage, and conversion of tobacco lands using current technology
  - **Equates to 1.26 – 1.51 billion gallons**
  - State of the Art technology could increase this to 2.4 billion gallon/year

- The economic value is significant
  - Ethanol Fuel Value @ 1.42 ¢/gallon: $1.7 - $2+ billion per year
  - Crop value paid to farmers: $131 - $263 million per year
  - Value paid to the forestry sector: $130 million per year
  - Farmers: $14 - $70 million per year in carbon credits (@10-50$/ton)
  - If 12 new 120-million gallons/year ethanol plants were sited in NC, the economic multiplier benefit would provide a one time $5 billion boost
  - Economy wide, 22-27,000 jobs could be created

E85 FFVs

- Over 4 million FFVs on U.S. roads today
- Major manufacturers – 2006 offerings

  Ford- Explorer, Taurus, F150

  Daimler Chrysler- Ram, Stratus, Sebring, Voyager, Caravan, Town & Country

  General Motors- Silverado, Tahoe, Suburban,Yukon, Avalanche, Impala, Malibu
- Nissan and Mercedes with 2007 models

E85 Fueling Systems

- All USTs that meet Dec. '98 EPA standards can be used to dispense E85.
- Replace aluminum parts with stainless steel nozzle, knobs, impeller, etc. Teflon hose, 1 micron filter.
- Clean tank.
- Modify existing unleaded system to dispense E85 for approximately $1,000

What is an FFV?

- **Flexible fuel vehicle (FFV) is specially designed to run on any ethanol blend up to 85%.**
- **FFVs may use any mix of gasoline or E85 – from 100% unleaded gasoline to 85% ethanol**
- **FFVs experience a mileage reduction on E85 vs. gasoline**

Retail Stations- Ethanol

- E10- 23 Crown Stations in Raleigh (United Energy)
- E10 & E85 in Shelby, Charlotte, Durham, Southern Pines, Pinehurst, & Statesville

Biodiesel

- NC uses more than 1 billion gallons of diesel fuel annually
- 5% blend of biodiesel=29 million bushels of soybeans
- 1 million acres soybeans
  - or 300,000 acres of rapeseed
  - or a combination of; waste vegetable oil, rendered animal fats, and refined vegetable oil

Biofuels Distributors

- Potter Oil & Tire Company (252) 322-4031
- World Energy (800) 256-4853
- Piedmont Biofuels (919) 542-2900
- United Energy Distributors (803) 641-1549
- Griffin Industries (859) 572-2589
- Osage (540) 375-6501
- Thomas Petroleum (800) 262-5453

Special 2005 Budget Provision ~ Section 19.5

- Requires state fleet to achieve a 20% reduction or displacement of current petroleum use by 2010
- Will spur use of alternative fuels, synthetic lubricants and efficient vehicles
- Effects all state agencies, universities and community colleges that have state owned vehicles (any fleet over 10 motor vehicles)
- Agencies must report annually by September 1st to Department of Administration (State Energy Office)

NC Tax Credits

- 25-35% credit for biofuel manufacturing plants
- 15% credit for Alternative Fuel Infrastructure
- 35% for Renewable Energy Applications
- Up to $2.5 million/application for industrial and commercial/Up to $10,500 for consumers
- Can be stacked on federal credits

2005 National Energy Bill- Alternative Fuel Highlights

- New "Renewable Fuels Standard" requires 7.5 billion gallons in 2012
- Allows credit of 2.5 gallons for every gallon of ethanol produced from wastes or cellulosic biomass sources
- 30% Tax Credit for Tanks and Pumps

NC Biofuel Production Plans

- Grain Growers Co-op: 30 mgy biodiesel plant near Mt. Olive
- Piedmont Biofuels:1 mgy biodiesel in Pittsboro---opens on September 25th
- Filter Specialty, Inc- .5-1.6 mgy biodiesel in Autryville
- AgriEthanol: 3 ethanol plants, first in Aurora
- Blue Ridge Biofuels
- Others coming….

Current Biofuels Projects in NC

- ***Golden LEAF Foundation***: grant to NCSU to evaluate energy crops for NC, including canola, switchgrass and hulless barley
- ***Assistance to Farmers and Rural Businesses***: USDA Section 9006 Renewable Energy and Energy Efficiency grant program/Farm Bill
- ***North Carolina Biomass Council***: formed by State Energy Office to promote economic development, increase energy security and reduce greenhouse gas and other emissions.
- ***NCSU***: received $1.6 million grant from USDA for a three-year project to convert waste glycerol from biodiesel production into more valuable chemicals.

NC Biofuels: varying markets and production plans

- **Developing markets:**
  - **Low blends of B2-B5 ~ farmers**
  - **E10 --- fleets, retail sites**
  - **B20 & E85 --- state & local governments, schools, private fleets, retail pumps**
  - **B100 --- cooperatives, biodiesel enthusiasts (Piedmont** Biofuels, Blue **Ridge Biofuels)**
- **What's next:**
  - **Untapped market - home heating oil**
  - **Expanded distribution points- currently few major suppliers, limited bulk storage for biodiesel**
  - **Expanded awareness and access- more stations selling B20 & E85 more fleets and individuals to support them**
  - **In state production**

Future Vision for North Carolina

- Site Conventional bidiesel and ethanol plants in the state using soybeans and corn
- Test and develop alternatives: canola and barley
- Site cellulose-to-ethanol pilot plant in North Carolina using state biomass
- Research the use of algae for the production of biodiesel
- Expand access for public
- Expand biofuel use by fleets

For More Information

- State Energy Office
- 1830A Tillery Place
- Raleigh, NC 27604
- 919-733-2230
- 800-662-7131 (NC only)
- 919-733-2953 (fax)
- www.energync.net
- Larry.Shirley@ncmail.net